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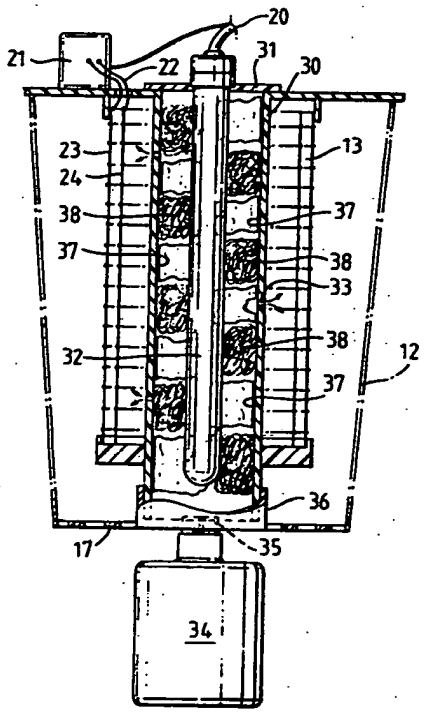
Published
With international search report.
With amended claims.

(54) Title: AN INSECT TRAP

(57) Abstract

The invention relates to an insect trap (10) for exterminating mosquitoes and other insects which feed on the blood of their victims. The insect trap (10) has a body (30) having a heat source (32) within it for attracting insects and an electrified grid (13) for exterminating the attracted insects. The interior of the body (30) has either selectively distributed heat conductive (38) or heat reflective material (37) or both within it whereby heat may be radiated from the body (30) according to a pattern established by the heat conductive (38) and/or reflective material (37). Such non-uniform areas of heat emission are more conductive to attracting mosquitoes and the like than uniform areas of heat emission.



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"AN INSECT TRAP"

THIS INVENTION relates to an insect trap. In particular the invention relates to a trap for exterminating mosquitoes and other insects which feed on the blood of their victims.

Insect traps commonly employed are those which use a light source, typically ultra violet light, and an electrified grid. The light is intended to attract the insects to the trap and lure them into contact with the grid. Such traps are effective for insects which are normally attracted by light. Insects, such as mosquitoes are not normally drawn to the victim by light although some mosquitoes are attracted by light at specific ages only. Generally such traps are not effective for mosquitoes and have a negative environmental effect because they attract and destroy non-harmful insects. Large insects such as moths are attracted by light emitting traps and tend to smoke or smoulder and give off an offensive smell. Many of the insects destroyed by light emitting traps are important in the ecosystem and their destruction can have a detrimental effect on natural cycles of the environment.

Other traps have been proposed which employ a chemical attractant. In recent times the use of chemicals has become less popular. Some traps have included the use of an attractant audible sound.

It has been discovered by experiment that mosquitoes are attracted by carbon dioxide gas exhaled by the victim and infra red radiation or heat within a specific wavelength range.

There have been traps proposed for mosquitoes which employ carbon dioxide, heat and an electrified grid. United States patent specification 4506473 discloses a device for generating carbon dioxide for use in an insect trap. United Stated patent specification 4519776 discloses an apparatus for attracting insects to an insect trapping device. The apparatus includes a source of carbon dioxide which in this case comprises a

burner communicating with a source of combustible fluid. An exothermic reaction produces carbon dioxide and a catalyst is employed for sustaining the reaction. A conventional insect trapping device is employed. This combination ensures that carbon dioxide, heat and moisture in amounts sufficient to attract a wide variety of mosquito species during both daylight and night time conditions are produced.

Further tests have shown that infra red patterns produced by the human body and other warm blooded animals are relatively uneven and bear a direct relationship to the amount of blood immediately beneath the surface of the body. For example, a relatively hot spot or area emitting large amounts of infra red radiation is indicative of a higher density of blood closer to the surface of a body than a cold spot. Such patterns are what insects such as mosquitoes are attracted to and enable them to distinguish between living and non-living heat emitting objects such as a sun warmed stone. Flames or lamps produce light and the distribution of infra red is relatively even. This is not conducive to effectively attract mosquitoes.

It is an object of the present invention to provide an insect trap which at least minimises the disadvantages referred to above.

According to one aspect of the invention there is provided an insect trap including a source of high voltage, a grid having spaced electrodes to which the high voltage may be applied, a body within the grid, a heat source within the body, the interior of the body having either selectively distributed heat conductive or heat reflective material or both within it whereby heat may be radiated from the body according to a pattern established by the heat conductive and/or reflective material.

The trap may be further provided with a source of carbon dioxide gas for injection into and/or around

the body for attracting insects to the trap.

The elongate body is preferably tubular. Although the body may be of any suitable transverse cross section it is preferred that it be circular in transverse cross section. The body may have a plurality of apertures through which carbon dioxide introduced into it may escape. The surface of the elongate body may typically emit infra red radiation of a temperature between 30°C and 40°C although slightly higher or lower temperatures may be present on areas of the surface.

The grid consists of two spaced electrodes. Preferably the electrodes are in the form of a screen. It is preferred that the electrodes be circular in transverse shape and the electrodes may be arranged one within the other. A concentric arrangement is preferred.

The high voltage applied to the electrodes is preferably between 2 to 6KV although it may be as high as 10KV. A voltage of 6KV is preferred. An alternating voltage of about 6KV is particularly preferred.

The reflective material may be a foil or any other reflective or insulating material.

The conductive material may be made of metal or any other conductive material. Spun metal or expanded metal may be employed. In one embodiment copper wool or the like is used and placed at discrete locations within the body and against the heat source.

The heat source may be a flame. Alternatively the heat source may comprise an electric heating element or light bulb or tube. The element is thermostatically controlled to emit an infra red radiation of between 36° to 42°C although slightly higher and lower temperature may be used.

A particular preferred embodiment of the invention will now be described by way of example with reference to the drawings in which:

Figure 1 is a diagrammatic perspective view of an insect trap according to an embodiment of the

invention; and

Figure 2 is a detailed elevational view of the trap of Figure 1.

With reference to the Figures there is shown an insect trap 10 having a housing consisting of an upper cover 11 and a lower foraminous surround 12. The cover 11 protects the trap to some degree from the elements while the surround 12 enables insects to enter and contact the electrified grid 13 and prevents accidental contact with the grid 13.

The cover 11 has an attachment 14 in the form of a ring for enabling the trap to be hung in position during use to make the trap accessible to flying insects. The cover has an upper panel 15 and four outwardly flaired side walls 16.

The surround 12 has four side walls with apertures enabling access to the grid 13. A base wall 17 also with apertures completes the surround.

Lead 20 enables the trap to be supplied with power. High voltage is generated by unit 21 and leads 22 enable the high voltage to be coupled to electrodes 23, 24 of the grid 13. Electrodes 23, 24 are in the form of spaced screens and insects which bridge this space are electrocuted.

An elongated body in the form of a tube 30 is located within the grid 13. The body is tubular and is closed off at its upper end by cap 31. Lead 20 extends through the cap 31 and supplies power to element 32. The element 32 provides the heat source for the trap 10. The body 30 has a plurality of apertures 33 in its wall.

Base wall 17 has secured thereto a cylinder 34 charged with carbon dioxide. Valve 35 coupled to cylinder 34 regulates the supply of carbon dioxide into the body 30. Carbon dioxide may escape from the body 30 through apertures 33.

The lower end of body 30 is received in spigot 36 extending from wall 17.

The interior of the body is selectively or randomly provided with spaced coatings of a heat reflective material 37 typically a metal foil. Heat conductive material 38 is located in the spaces between the reflective foil 37. The conductive material enables heat generated by the lamp to more readily be transferred to the body 30 from which it may then be radiated to attract insects. This ensures that the thermal image presented by the body is not one of a uniform heat radiator. An uneven or random radiating pattern is achieved which to mosquitoes appears more like the heat image presented by part of the human body.

The body 30 may simply have selectively or randomly spaced pieces of reflective foil. Alternatively only randomly spaced heat conductive material need be present. Alternatively both types of material may be present within the body.

The lower end of body 30 is received in spigot 36 extending from wall 17.

Comparative tests have been conducted to establish the effectiveness of the trap of the invention and the results of the tests are as follows:-

Date 1991	CO_2 + Infra red in random pattern	Infra Red Alone	Uniform Heat Source + CO_2
Jan 22	85		
23	68		
24	79		
25	49		
26	53		
27	46		
28	32		
31	9		
Feb 4	11		
5	18		
6	19	0	
7	15	0	2
8	8	0	0
9	10		
12	3	0	-
13	2	0	0
14	-		CO_2 Only
15	-		0
			Uniform Heat Source + CO_2
25	79		
26	25		0
27			3
28			0
Mar 1	28		
4	16		
5	16		

The trap was turned on at a predetermined time on the dates indicated and at a predetermined time each following morning a mosquito count was taken and the trap emptied for the next test. The second column is representative of the insect count for the trap according to the invention. The trap was not on for all of the days between 22 January, 1991 and 5 March, 1991. The date for which no readings were taken are shown. For dates between 7 February and 25 February a like trap to that of the invention was also set up adjacent to the trap under test. This like trap was configured to emit infra red only in a random pattern. No. carbon dioxide was emitted. For those days that unit did not kill any mosquitoes. These results are in column 3. Column four shows mosquito counts for a unit which emitted infra red

from a uniform source together with carbon dioxide. For 15 February the heat source was turned off and only carbon dioxide emitted - no mosquitoes were killed.

CLAIMS:

1. An insect trap including a source of high voltage, a grid having spaced electrodes to which the high voltage may be applied, a body within the grid, a heat source within the body, the interior of the body having either selectively distributed heat conductive or heat reflective material or both within it whereby heat may be radiated from the body according to a pattern established by the heat conductive and/or reflective material.

2. The insect trap as claimed in claim 1, including a source of carbon dioxide gas for injection into and/or around the body for attracting insects to the trap.

3. The insect trap as claimed in claim 2 wherein the body has a plurality of apertures through which the carbon dioxide gas introduced into the body may escape.

4. The insect trap as claimed in claim 1 wherein each of the electrodes are in the form of a tubular screen, one electrode being arranged within the other.

5. The insect trap as claimed in claim 4, wherein each of the electrodes is circular in transverse shape, one electrode being arranged within the other such that the electrodes are concentric.

6. The insect trap as claimed in claim 4 wherein the body is tubular.

7. The insect trap as claimed in claim 1 wherein the reflective material comprises foil.

8. The insect trap as claimed in claim 1 wherein the conductive material comprises spun metal or expanded metal.

9. The insect trap as claimed in claim 1 wherein the heat source comprises an electric heating element.

10. The insect trap as claimed in claim 9 wherein the element is controlled to emit infrared radiation of between 36°C to 42°C.

AMENDED CLAIMS

[received by the International Bureau on 28 August 1992 (28.08.92); original claim 1 amended; remaining claims unchanged (1 page)]

1. An insect trap including a source of high voltage, a grid having spaced electrodes to which the high voltage may be applied, a body within the grid, a heat source within the body, either selectively distributed heat conductive or heat reflective material or both disposed between the heat source and the grid, whereby heat may be radiated from the body according to a pattern established by the heat conductive and/or reflective material.

2. The insect trap as claimed in claim 1, including a source of carbon dioxide gas for injection into and/or around the body for attracting insects to the trap.

3. The insect trap as claimed in claim 2 wherein the body has a plurality of apertures through which the carbon dioxide gas introduced into the body may escape.

4. The insect trap as claimed in claim 1 wherein each of the electrodes are in the form of a tubular screen, one electrode being arranged within the other.

5. The insect trap as claimed in claim 4, wherein each of the electrodes is circular in transverse shape, one electrode being arranged within the other such that the electrodes are concentric.

6. The insect trap as claimed in claim 4 wherein the body is tubular.

7. The insect trap as claimed in claim 1 wherein the reflective material comprises foil.

8. The insect trap as claimed in claim 1 wherein the conductive material comprises spun metal or expanded metal.

9. The insect trap as claimed in claim 1 wherein the heat source comprises an electric heating element.

10. The insect trap as claimed in claim 9 wherein the element is controlled to emit infrared radiation of between 36°C to 42°C.

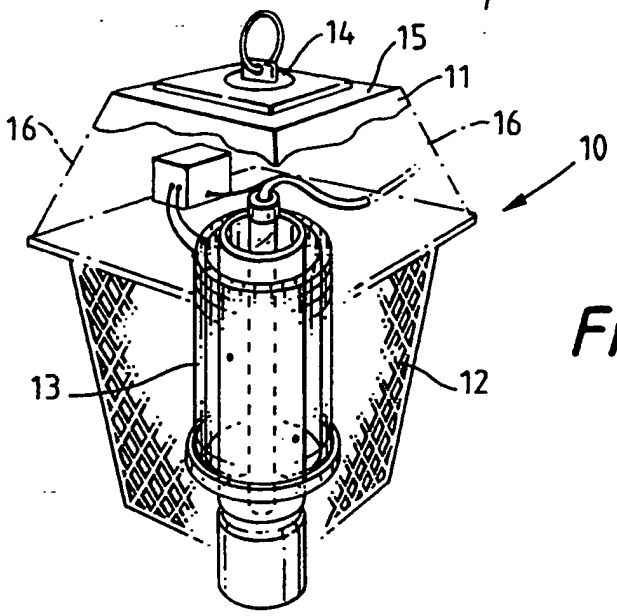
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Fig.1.

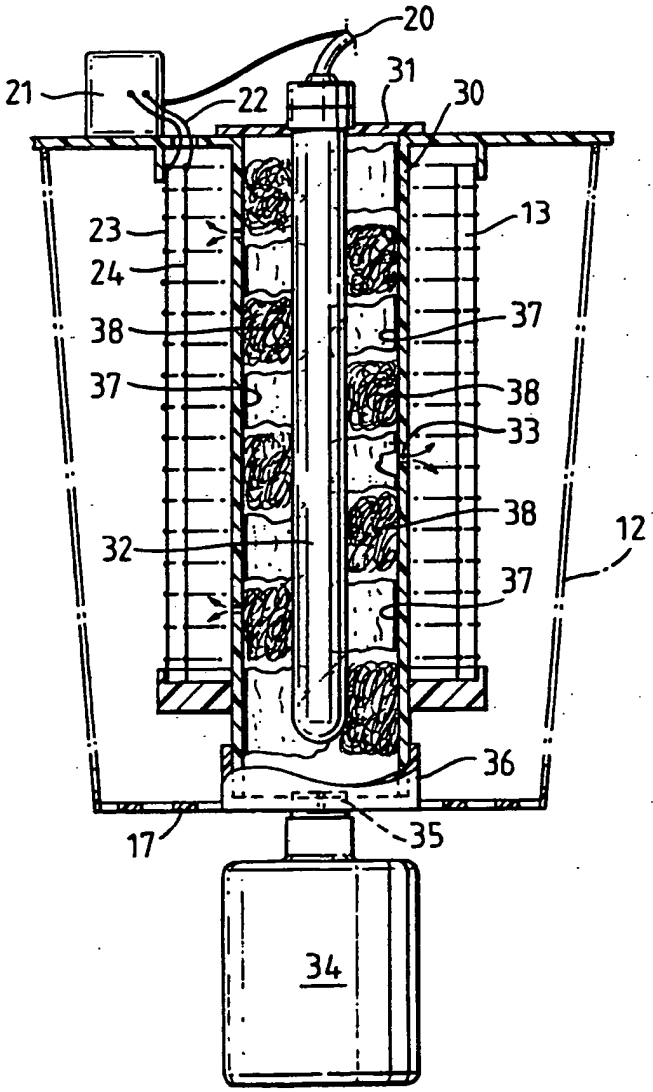
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Fig.2.

INTERNATIONAL SEARCH REPORT

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent classification (IPC) or to both National Classification and IPC

Int. Cl.[5] A01M 1/02, 1/22, 1/04

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	A01M 1/02, 1/22, 1/04, 1/10, 19/00, 23/38

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

AU : IPC as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category*	Citation of Document, [11] with indication, where appropriate of the relevant passages [12]	Relevant to Claim No [13]
X	US,A, 4182069 (De YOREO) 8 January 1980 (08.01.80) See column 1 line 57 to column 2 line 18	(1,4-6,9)
X	US,A, 3950886 (NEWHALL) 20 April 1976 (20.04.76) See whole document	(1,4-6,9)
X	US,A, 4387529 (HEDSTROM) 14 June 1983 (14.06.83) See fig 2,3	(1,9)
Y	US,A, 4519776 (De YOREO et al) 28 May 1985 (28.05.85) See whole document	(1-9)
	(continued)	

* Special categories of cited documents : [10]

"A" Document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior t the international filing date but later than the priority date claimed

"T" Later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
24 June 1992 (24.06.92)	3 July 1992 (03.07.92)
International Searching Authority	Signature of Authorized Officer
AUSTRALIAN PATENT OFFICE	B.R. DASHWOOD

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

Y	US,A, 4506473 (WATERS, Jr) 26 March 1985 (26.03.85) See whole document	(1-9)
X	US,A, 3894351 (IANNINI) 15 July 1975 (15.07.75) See whole document	(1,4,5,7,9)

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [1]

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim numbers ..., because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim numbers ..., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim numbers ..., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4a

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [2]

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.
2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL APPLICATION NO. PCT/AU 92/00137

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Member		
US 4182069	CA 1089527	DE 2739896	FR 2395703
	GB 1576748	JP 54015878	
US 4387529	US 4248005		
US 3894351	FR 2275146	GB 1456477	IT 1038794
	JP 51010082	NL 7506870	SE 7507055